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The Tertiary plants from the valley of the River Buchtama, at the foot of the Atlas, and described in *Palæontographica* (1886-87) by J. Schmalhausen.

PLISTOCENE.—Carl Oehsenius has contributed two papers upon the age of some parts of the South American Andes to the *Zeitschrift der Deut. Geol. Ges.* (1877). He attributes the elevation of the platform of Lake Titicaca to volcanic action, and assigns it to quaternary time.

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## MINERALOGY AND PETROGRAPHY.<sup>1</sup>

PETROGRAPHICAL NEWS.—In an article on the contact phenomena presented by certain Scottish olivine diabases, cutting sandstones and shales, Stecher<sup>2</sup> gives us some new and important ideas on the general subject of contact action. These olivine diabases are carefully described in all their varieties. Skeleton crystals of apatite, corroded augites, twinned plagioclase, dihexahedra of quartz, and various rare minerals are noted in them. The quartz shows anomalous action in polarized light, and is peculiar in that its hexagonal sections are seen under crossed nicols to consist of a kernel of quartz substance, surrounded by a rim of calcite. In some instances the olivine yields analcite by alteration. The most interesting portion of the paper is that which treats of the endogenous changes which have taken place in the dykes under the influence of the intruded rocks. Although more acid on their edges and in the neighborhood of sandstone inclusions, it was found that only in these places in the dykes is there any considerable development of olivine in perfect crystals. At a somewhat greater distance from the contact, the olivine becomes more skeleton-like in form. In the centre of the dykes it is absent. This is accounted for by Stecher in supposing that the material of the dykes cooled quickly on its edges, and thus preserved in their entirety the olivine which had already crystallized before the rock reached the surface of the earth. As the inner portion cooled more gradually, the magma became more acid as it dissolved material from the sandstone and slate pieces, torn from its walls, and thus re-dissolved the olivine, and then solidified under the changed conditions.—In contrast to the results obtained by Stecher, in which the effect of contact action is seen only in the eruptive rock, are those obtained by Greimi<sup>3</sup> in his studies of the phenomena presented by the intrusion of the Upper-Devon-

<sup>1</sup> Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

<sup>2</sup> *Min. u. Petrog. Mitth.* ix., 1887, p. 145.

<sup>3</sup> *Neues Jahrb. f. Min., etc.*, 1881, i., p. 1.

ian schists by diabase, in the neighborhood of Weilburg an the Lahn, in Hessen, Nassau. In this case the diabase itself has suffered little alteration, but the schists show to a greater or less degree the effects of metamorphic action. The unaltered schists are composed of quartz, muscovite, hematite and other iron oxides, in which are lenticular areas and beds of calcite. Where altered they are seen to contain an isotropic groundmass in which are quartz, mica and a chloritic mineral. In addition to these the two newly formed minerals spinel and andalusite occur. In discussing his results, Greim concludes that the diabase supplied sodium and iron to the schists, which then underwent the alteration which is supposed by Rosenbusch to be characteristic of deep-seated metamorphism. —A third excellent paper on contact phenomena is that communicated by Rüdemann. This author has investigated the effect of the granite occurring at Reuth, near Gefrees, in the Fichtelgebirge, upon the clay slates, phyllites and amphibolites through which it cuts. He carefully describes the knotty-schists (*Knoten-schiefer*), the chialtolite and andalusite schists, and the hornfels resulting from this action, and reaches some general conclusions relative to the way in which an eruptive rock acts in the production of what are commonly known as contact rocks. In both phyllites and clay slates the first result of the metamorphic action is the concentration of certain of their constituents to form the spots (*Knoten*). In this stage there is little or no other change to be detected. The next stage is characterized by the formation of porphyritic crystals, chialtolite in the clay slates of Reuth and other localities, and biotite in the case of phyllites (*Garbenschiefer*). In the first case the andalusite owes its origin to the alteration of a light green chloritic mineral (*grümbelite*). In the case of the phyllites biotite replaces chlorite. In the third stage the end product of the alteration both of clay slates and phyllites is hornfels. This is a crystalline rock composed of quartz, biotite, muscovite and andalusite grains. Assuming that these changes in the sedimentary beds are directly connected with the presence of the large granite mass which they surround, the author supposes the earlier stages in the alteration to be due to the intense heating to which the rocks were subjected at the time of their intrusion by the granite. This is shown by the fact that in different beds different contact minerals have been produced, while the composition of the altered rocks corresponds to that of the corresponding unaltered beds from which they were derived. To account for the formation of hornfels, and the minerals so commonly found in it, Rüdemann supposes the energetic action of hot waters upon the constituents of the fragmental rocks. The paper is exceedingly well written, and contains very much of interest.—In connection with the discussion of

contact phenomena, a late paper by Hussak,<sup>1</sup> on the origin of the spots in altered sedimentary rocks (Knoten- and Frucht-schiefer) is worthy of close study. Rosenbusch regards these spots as due to the aggregation of the pigment, which was distributed evenly throughout the fragmental rocks before their intrusion by the eruptives. In certain cases he supposes these aggregations to pass by recrystallization into chialstolite and andalusite. Ward regards them as undeveloped andalusites. Other writers have described them as possessing characteristics which indicate their close connection with other mineral species. Hussak, upon examining the spotted schists from Tirpersdorf, Saxony and Hlinsko, Bohemia, found that the darker portions of the altered schists possess properties which can only be explained by supposing them to be the remains of altered cordierite, in the case of the Saxon rocks, and of altered chialstolites and andalusites in the rocks from Bohemia.

MINERALOGICAL NEWS.—Busz<sup>2</sup> has recently made quite an extensive study of *sphene* in order to determine whether the optical properties of different crystals are in any way dependent upon their chemical composition. Although quite a number of analyses of well crystallized specimens from various localities were made, no direct relation "could be traced between their compositions and optical properties. The most instructive portion of the paper is that which treats of the crystallography of the subject. Crystals of nine different types are pictured on three lithographic plates. A number of new forms were detected, which added to those already known make a total of seventy-five thus far identified on the species.—Köchlin<sup>3</sup> has examined several of the oxides of manganese to decide as to the correctness of certain views held in regard to them. He finds as the result of etching that *manganite* is holohedral as Groth supposed. He believes *polianite* to exist as an independent mineral species distinct from manganite. It is orthorhombic, with an axial ratio: 1 : 10513 ; 1 : 0.63177. Finally, he regards *pyrolusite* as a mixture without a definite composition. "Its substance is not individualized; it has no proper crystal form." It occurs almost exclusively as a decomposition product of other manganese minerals.—Although *pseudobrookite* was first described by Koch<sup>4</sup> some ten years ago, our knowledge of its optical properties is very limited. A new discovery of little crystals of the mineral in a nephelinite from Katzenbuckel has given Lattermann<sup>5</sup> the opportunity to determine its optical constants. The tiny crystals are bounded by the planes  $\infty P_{\infty}$ ,  $\infty P_{\infty}$ ,  $\infty P$  and  $\frac{1}{2} P_{\infty}$ . Their color is orange brown. They are weakly pleochroic. The plane

<sup>1</sup> Min. u. Petrog. Notizen, Bonn.

<sup>2</sup> Neues Jahrb. f. Min., etc., Beil. Bd. v., p. 330.

<sup>3</sup> Min. u. Petrog. Mitth. ix., 1887, p. 22.

<sup>4</sup> Min. u. Petrog. Mitth., 1878, i., p. 344.

<sup>5</sup> Min. u. Petrog. Mitth. ix., 1887, p. 47.

of their optical axes is the basal pinacoid, and the axial angle, measured in oil, is  $85^{\circ} 30'$ .  $A$  is the acute bisectrix. The mineral is insoluble in hydrochloric acid. It dissolves slowly in boiling sulphuric acid, but rapidly in a mixture of sulphuric and hydrochloric acids. An analyses of separated material yielded:  $\text{TiO}_2 = 46.79\%$ ;  $\text{Fe}_2\text{O}_3 = 48.64\%$   $\text{MgO} = 4.53\%$ . Very beautiful rich red, transparent crystals of *rhodochrosite* are described by G. F. Kunz<sup>1</sup> from the John Reed mine in Alicante, Lake co., Colorado. Some of the crystals from this locality "are as pellucid as red Iceland span and show the same double refraction." The same author<sup>2</sup> describes some curious groups of quartz crystals from the vicinity of the town of Pinal, Pinal CO., Arizona. Six or more little crystals of the usual form are so arranged as to form a hollow cylinder, with the general outline of a large quartz crystal. He also mentions a white opaque variety of hydrophane from Colorado, which is remarkable in that it can absorb more than its own volume of water. When wet it is perfectly transparent.—Mr. R. B. Riggs<sup>3</sup> of the United States Geological Survey has published the results of the analyses of a suite of tourmaline crystals from various localities. The conclusions reached by Mr. Riggs, after an immense amount of very careful work, are of very great interest as establishing with a good deal of accuracy the composition of this complicated group of minerals. The figures obtained lead the author to regard tourmaline as a simple boro-silicate with the general formula  $\text{R}_9\text{Bo}_2(\text{SiO}_4)_2$ , which for the three types recognized by him became:

I. Lithia tourmaline  $= 12 \text{ SiO}_2. 3\text{B}_2\text{O}_3. 4\text{H}_2\text{O}. 8\text{Al}_2\text{O}_3. 2(\text{NaLi})_2\text{O}.$

II. Iron tourmaline  $= 12 \text{ SiO}_2. 3 \text{B}_2\text{O}_3. 4\text{H}_2\text{O}. 7\text{Al}_2\text{O}_3. 4 \text{FeO}. \text{Na}_2\text{O}.$

III. Magnesia tourmaline  $= 12 \text{ SiO}_2. 3\text{B}_2\text{O}_3. 4\text{H}_2\text{O}. 5\text{Al}_2\text{O}_3. \frac{2}{3}\text{MgO}. \frac{2}{3}\text{Na}_2\text{O}.$

It is interesting to note that while the color of the iron and magnesian varieties depends upon the *amount* of iron in their compositions, in the case of the lithium varieties, containing manganese and iron, it depends upon the *ratio* between the manganese and iron constituent, being colorless, pink or pale green when the amounts of these are equal, red when manganese is in excess, and green or blue when iron is in larger quantity.

<sup>1</sup> Amer. Jour. Sci., Dec. 1887, p. 477.

<sup>2</sup> Ib., p. 479.

<sup>3</sup> Ib., Jan., 1888, p. 35.